Won’t You Be My Neighbor?

New Georgia Tech research complex encourages collaboration at the intersection of disciplines.

By John Toon

When materials scientist Ken Sandhage needs to consult with a chemist, biologist or even an electrical engineer, he need only step up or down a few flights of stairs in Georgia Tech’s new Molecular Science & Engineering Building (MS&E).

“It’s much easier to have productive conversations in the hallways if you are clustered in a building with people who have similar research interests, even if they aren’t in the same department,” he says. “I don’t have to walk across campus to find someone to talk with about an issue outside of my own discipline.”

Easy collaboration across disciplines and departments provided the design goal for the five-story, 275,000-square-foot structure that opened in August 2006. Everything about it – including the location of faculty offices, design of interior open spaces and orientation to other buildings in the complex – encourages faculty from a broad cross-section of Georgia Tech to work together.

Even Sandhage’s lab is interdisciplinary, a necessity to support his interest: creating tiny electronic devices from the unique 3-D microshells of diatoms. His lab includes a cell culture room for growing the brownish-red phytoplankton, traditional ceramic engineering furnaces, an electronic test station – and a biochemistry lab for studying peptides that induce the formation of functional inorganic materials.

MS&E can house 41 principal investigators, 50 support staff and more than 400 research staff and graduate students. Research done in the building includes materials and polymer characterization, bio-nanotechnology, chemistry and biomolecular engineering, biomaterials, membrane fabrication, nanochemistry, molecular biophysics and computational chemistry. Five schools from Georgia Tech’s College of Sciences and College of Engineering are represented.

That suits Joe Perry’s work well. A faculty member in the School of Chemistry and Biochemistry, he’s part of the Center for Organic Photonics and Electronics – which already includes researchers from different schools.

“Just the fact that we run into one another in hallways creates exchanges that can lead to great new ideas,” he says. “If these collaborators weren’t in the building, I’d have to pick up the phone and potentially interrupt somebody’s work. It’s a different dynamic when you can talk with somebody face-to-face.”

Gary Schuster likes to hear words like those. As dean of Georgia Tech’s College of Sciences, he was heavily involved in the design of the building. Now, as Georgia Tech’s provost, he’s seeing the rewards of that strategy.

“We have built our new buildings so they are interactive and flexible, with a lot of open meeting space,” he says. “We have tried to provide a social, interactive environment that allows easy collaboration and cooperation.”

But there’s much more to it than that.

Building “Research Neighborhoods”

Universities traditionally organize themselves around disciplines, part of a “reductionist” approach that solves difficult problems by breaking them down into pieces small enough to understand. That approach has worked well, and is necessary to gain the depth need-
ed to make progress within disciplines, Schuster says.  

But that approach won't work against complex and interrelated problems, such as understanding the social aspects of biological systems. Take ant colonies, for example.

“If your objective is to understand ant colonies, you can’t study just one ant,” Schuster explains. “All of the interactions of ant colonies, which are very complex structures, emerge from interactions among ants. A lot of the problems that the world now faces are of the character of ant colonies.”

For instance, he notes, solutions to the world’s energy problems must consider not only such issues as British thermal units (Btu) and electrical efficiency, but also environmental impact and sustainability. Those are “emergent” problems, and they must be
solved holistically – and at the intersection of different disciplines.

Hence the organization of the Molecular Science & Engineering building into “research neighborhoods” housing faculty members from different disciplines who are working on similar issues – but from different perspectives. The concept was also applied in the Ford Environmental Science & Technology Building (ES&T), which is also part of Georgia Tech’s four-building Biotechnology Complex.

“What we have done is try to build a physical infrastructure that supports the reductionist approach, but has an emergent overarching view,” Schuster explains. “We didn’t build a chemistry building or chemical engineering building. We built the Environmental Science & Technology Building, and we built the Molecular Science & Engineering Building. We still have departments that have the disciplinary expertise, but we’ve put people together to solve the emergent problems.”

Within the new building, which completes the four-building complex, faculty offices are clustered in a “wedge” to encourage casual conversations. The traditional approach would have put faculty together with their laboratories and space for graduate students.

“That puts the faculty into interaction with people, regardless of what their degrees happen to be, who are thinking about similar things, but from different perspectives,” Schuster explains. “An electrical engineering faculty member is likely to have his or her office next to a chemistry faculty member.”

The faculty members still interact with their graduate students, of course, and the students also benefit from neighbors who may approach issues from a different perspective.

The Impact of Life Sciences

The Environmental Science & Technology Building is the largest research facility on the Georgia Tech campus. The new Molecular Science & Engineering Building is the second-largest. That both are part of the new Biotechnology Complex demonstrates the importance of the life sciences to Georgia Tech, which emerged on the national scene through its strengths in industrial, mechanical, civil, aerospace and other traditional engineering areas.

But that traditional focus is changing rapidly.

“Georgia Tech is defining its own path through the biosciences,” Schuster continues. “The path we are defining comes from our tradition of being quantitative and analytical, and this results in a style of approaching life sciences that allows us to step back and apply our strengths. We are able to combine the quantitative engineering and scientific challenges of Georgia Tech with a strong medical school in Emory University.”

That collaboration, for example, led to
Issues of sustainability also affected the design of the Molecular Science & Engineering Building, which will be part of the planned Eco-Commons on the Georgia Tech campus.
Reconsidering the Physical Environment

Georgia Tech’s growth created an opportunity to reconsider how the physical environment affects research, teaching and service. Over the past decade, it has invested nearly $1 billion in new and remodeled facilities, including the Biotechnology Complex.

“Tackled allowed us to think about what a major research university of the 21st century should look like, and it gave us enough flexibility in the construction projects to think seriously about what we wanted to be,” Schuster explains. “We were able to think strategically.”

But in encouraging collaboration, administrators can do only so much. They can create a supportive environment, but the organization of projects will be done by faculty members who form natural alliances based on mutual benefit.

“I’m a big fan of self-organizing systems,” Schuster adds. “It’s the responsibility of the administration to be strategic in its thinking and to set the boundary conditions and goals. We have to provide the facilities to allow the faculty members and students to operate. That encourages a spirit of entrepreneurship among our faculty, and leads to collaborations not only within Georgia Tech, but also with government and industry.”

The Biotechnology Complex carries entrepreneurship to an unusual level with the ATDC Biosciences Center. Located in the ES&T Building, the Center is a satellite facility of Georgia Tech’s science and technology incubator, the Advanced Technology Development Center. The ATDC facility allows researchers with offices and labs in the Complex to tend their companies while maintaining their regular Georgia Tech duties.

A recent graduate of the facility is CardioMEMS, a maker of implantable medical sensing devices that has raised more than $50 million in venture funding since 2001. The incubator currently houses three companies focused on life-science markets.

Beyond entrepreneurship, the self-assembly of chemists, biochemists, materials engineers, biomedical engineers, electrical engineers, mechanical engineers and other specialists has already begun to pay off, says Thomas Orlando, chair of Georgia Tech’s School of Chemistry and Biochemistry – Joe Perry’s home department.

“We have had new faculty join us due to our ability to work together, and this has helped in recruiting some of the best talent in the world,” he reports. “We have also noticed that the interdisciplinary nature of our school has been attractive to graduate students and has helped increase the number and quality of students.”

Connecting to Green Space

Located in booming midtown Atlanta, Georgia Tech could easily become a concrete wasteland. But creating an attractive environment was important to the school’s administration. So the new MS&E Building connects the Biotechnology Complex to an attractive bit of forest in the city – the President’s Glade, located behind the campus home of President Wayne Clough.

The facility will also be part of the planned Eco-Commons, which will restore creeks and green space destroyed by development during the last century.

Issues of sustainability also drove the building’s design, which was done by the architectural firm CUH2A, Inc. To reduce storm water runoff from the building, for instance, the architects incorporated cisterns that store rainwater and use it for landscape irrigation. Condensation from the building’s HVAC system is also used for irrigation – instead of being dumped into the city’s sewerage system.

“We also got rid of a lot of concrete that had been in the area and restored permeable soil that allows water to percolate into the ground,” notes Fred Dolder, senior capital projects manager in the Georgia Tech Facilities Department. “Terracing of a new quad within the four-building complex provides a great space for the community to sit and enjoy the sun.”

The $77 million facility also features an energy recovery system designed to reduce utility costs and cut the building’s impact on the environment. A dramatic glass wall faces north – away from the sun – while south-facing windows were designed to admit light while keeping out direct sunlight during the hot Georgia summers. More than three-quarters of the building’s space has access to natural light.

Laboratory spaces were designed to be modular, easily reconfigurable to meet changing needs – and hold down construction and renovation costs. Service hallways ensure that supply deliveries are kept separate from pedestrian traffic. Beyond the research laboratories, the MS&E building provides four 40-seat classrooms and a 150-seat lecture hall.

The building replaced facilities that had been the headquarters for Georgia Tech’s Facilities Department. Many of the maintenance activities associated with that unit were integrated into the MS&E Building – but few students and faculty will ever see them because they were separated from public spaces by an access tunnel.

In addition to classroom, office and laboratory spaces, the building also features a two-level 8,000 square-foot “Quad Café” – a restaurant and coffee shop that Dolder describes as the “little jewel” of the project. To be operated by Georgia Tech’s Auxiliary
Services, the café will also support the goals of interdisciplinary collaboration.

The project’s construction manager was Turner Construction Company, and project management was handled by the Staubach Company. Though portions of the building remain to be built out, Dolder considers the project an overwhelming success.

“It was an excellent project not only from the design perspective, but also for the quality of the construction and the teamwork in pulling it off,” he adds. “We wanted to create a pleasant environment that would encourage collaboration and interdisciplinary research. When you take these four buildings together with the type of work that is done here, it’s a very powerful site by any measure.”

Robert Snyder, chair of Georgia Tech’s School of Materials Science and Engineering – Ken Sandhage’s home department – has his own measure for judging the project a success.

“The Molecular Science & Engineering Building has many of our bio- and bio-enabled faculty working next to nanomaterials faculty who have an interest in cancer, who are next to biomedical engineering faculty and students,” he points out. “We have succeeded in knocking down the old traditional walls between engineering and science disciplines. The synergy can be felt in the air.”

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– Ken Sandhage, professor in the School of Materials Science and Engineering

Photo: Gary Meek